UNIVERSITY OF MISKOLC
FACULTY OF MECHANICAL ENGINEERING

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE OPERATION OF SPRING-LOADED SAFETY VALVE

PHD THESIS BROCHURE

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NEW SCIENTIFIC RESULTS

I. I developed a new method based on experimental and numerical procedures for the determination of the flow-force characteristic curve. This method can be used for computer aided simulation of safety valve operation. [P2, P5, P6].

I.1. I identified a new way to calculate the starting point of the flow-force characteristic curve and verified it with experiments. I showed that the difference between this method and the ones published in specialised literature is the result of the displacement of the discontinuous pressure function surface between the back pressure and the set pressure.

I.2. I composed a numerical method for the approximation of measured and calculated base points of the flow-force characteristic curve by using basis functions consisting of 8^{th} degree Legendre polynomials.

II. I set up a mechanical model of spring-loaded safety valve that is suitable for high-reliability investigations. [P1, P2, P3, P4, P6, P7, P10].

II.1. I corrected a procedure published in specialised literature that investigated the consideration of spring mass.

II.2. I developed an investigation method for determining the linear damping coefficient characterising the moving parts of safety valve with limited displacement. I showed the stability of this characteristic within the typical range of the safety valve's disc displacement.

II.3. I developed an investigation method for determining the Coulomb's damping force characterising the moving parts of safety valve with limited displacement. I showed the stability of this characteristic within the typical range of the safety valve's disc displacement.

II.4. I elaborated an experimental method to determine the impact coefficients characterising the impact effects between the valve disc and the guideplate or between the valve disc and the valve seat.

III. I set up a concentrated parametric fluid mechanics model of a technological system protected by safety valve. This model is suitable for determining the pressure and temperature changes in the protected system. [P2, P8, P9].

III.1. I identified an iterative method for the calculation of the characteristics of the gas-flow within an adiabatic pipe with orifice.

III.2. I produced an approximated function of the discharge-coefficient function.

IV. Based on the approximation of the flow-force characteristic curve, the mechanical model of the safety valve and the fluid mechanics model of the protected system I prepared a computer program, that is suitable for describing the operation of the safety valve and can be generally used for solving safety problems. [P1, P2, P6, P8, P9, P10].

IV.1. I verified the applicability of the computer program by experiments.

IV.2. I showed that when choosing safety valves the volume of the protected pressure vessel has to be considered.

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[P3] *Bene, F.; Léderer, P.; Ortutay, M., Siménfalvi, Z.*: Biztonsági szelep nyitási folyamata, fejlesztési lehetőségek, Gép 1997/11. pp. 15-17.

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[P5] *Siménfalvi, Z.*: Biztonsági szelepek felhajtóerő-karakterisztikájának meghatározása laboratóriumi mérési eredmények felhasználásával, Munkavédelem és biztonságtechnika, 1998/1. pp. 47-52.

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[P10] *Patkó, Gy., Ortutay, M., Siménfalvi, Z.*: On vibrations during operation of safety valve's disc, Publ. Univ. of Miskolc, Series C, Mechanical Engineering, Vol. 49. (1999) pp. 135-142.